Citation:

Dubois L, Farmer A, Girard M, Peterson K. Regular sugar-sweetened beverage consumption between meals increases risk of overweight among preschool-aged children. *J Am Diet Assoc*. 2007 Jun;107(6):924-34; discussion 934-5.

PubMed ID: 17524711

Study Design:

Longitudinal Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

The purpose of this study was to examine the relationship between sugar-sweetened beverage consumption (e.g., carbonated soft drinks and fruit drinks) between meals and the prevalence of overweight among preschoolers.

Inclusion Criteria:

Data were used from the Longitudinal Study of Child Development in Quebec (1998-2002), including children from 2.5 to 4.5 years, from a representative sample of children born in 1998 in the province of Quebec. Consent was given.

Exclusion Criteria:

None specifically mentioned.

Description of Study Protocol:

Recruitment: The Longitudinal Study of Child Development in Quebec followed a representative sample of children born in 1998 in Quebec, chosen by a random selection from each of the public health geographical areas in Quebec.

Design: Longitudinal study

Children were seen at 5 months and once a year thereafter. The study was based on face-to-face interviews and self-administered questionnaires completed by the mother. Nutrition assessment included a 24-hour diet recall, a food frequency questionnaire (FFQ) and measurement of children's height and weight.

Blinding used: implied with measurements

Intervention: not applicable

Statistical Analysis:

- Analysis included individuals with no missing values for any of the variables studied.
- First the data were treated cross-sectionally at 2.5, 3.5, and 4.5 years.
- From these analyses, two longitudinal indicators (i.e., regular consumers and daily consumers) were created.
- Longitudinal analyses examined sugar-sweetened beverage consumption over time and performed cross-sectional analyses of overall consumption with body weight at age 4.5 years.
- SAS software was used for analysis.
- Adjusted odds ratios (ORs) estimates with confidence intervals were computed using logistic regressions.

Data Collection Summary:

Timing of Measurements

- Data were collected when children were aged 2.5, 3.5, and 4.5 years, from 2000 to 2002.

Dependent Variables

- BMI, calculated from measures of actual height and weight following standard procedures

Independent Variables

- Sugar-sweetened beverage (drink with added sugar) consumption

Control Variables

- Demographic factors such as maternal age, education, family income
- Sex, maternal smoking status during pregnancy, and children's physical activity were considered potential confounders and were included in the multivariate analysis.

Description of Actual Data Sample:

Initial N: 2,103 randomly selected, 1,944 remained in the study at data collection 2002.

Attrition (final N): 1,549 participated in the nutrition study, and 1,499 (97%) were part of the analyses.

Age: 2.5-4.5 years

Ethnicity: not described

Other relevant demographics:

Anthropometrics: Overweight defined as >95th percentile on US CDC growth charts.

Location: Children born in province of Quebec, Canada

Summary of Results:

Key Findings:

- 14-16% of children consumed sugar-sweetened beverages between meals every day at ages 2.5, 3.5 and 4.5 years.
- 31% were nonconsumers of sugar-sweetened beverages between meals at those ages.
- Maternal age and family income were inversely related to daily consumption of sugar sweetened beverages between meals at ages 2.5, 3.5 and 4.5 years.
- 17.2% of children consumed sugar-sweetened beverages daily (at meals or between meals) at age 4.5 years.
- Overall, 6.9% of children who were nonconsumers of sugar-sweetened beverages between meals between the ages of 2.5 to 4.5 years were overweight at 4.5 years, compared to 15.4% of regular consumers (4 - 6 times or more per week) at ages 2.5 years, 3.5 years and 4.5 years.
- Total daily consumption of sugar-sweetened beverages is not related with overweight at age 4.5 years, but daily consumption between meals is related. More than twice the children who were regular consumers at the three ages were overweight at 4.5 years (7% vs 15%). Regular consumption more than doubles the odds (OR 2.4, CI 1.105-5.054, P≤0.05) of being overweight.
- Total energy intake was also related to overweight. Even with these elements added to the analysis, regular sugar-sweetened beverage consumption still doubles the odds (OR 2.1, CI 1.002-4.701, P≤0.05) of being overweight at age 4.5 years.
- Compared to children who were nonconsumers and from sufficient income families, consumption of sugar-sweetened beverages between meals regularly from age 2.5-4.5 years almost triples the odds (OR 2.7, CI 1.2-6.3, P≤0.05) of being overweight for children from income sufficient families and more than triples the odds (OR 3.4, CI 1.0-12.1, P≤0.05) for children from insufficient and very insufficient income families.

Author Conclusion:

Regular sugar-sweetened beverage consumption, specifically between meals, may put some young children at greater risk for overweight in childhood. Families in economic stress may cope by buying cheaper, less nutrient-dense, calorie rich foods, and parental education is needed.

Reviewer Comments:

Authors note the following limitations:

- *Self-reported intakes*
- *Unable to examine the effects of subcategories of sugar-sweetened beverages because they were combined into one question on the FFQ*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A

3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes

6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes

9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes